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There are many different patents for artificial rubber, but none of these can as yet be regarded as really successful substitutes. The white substitutes are made from vegetable oils, usually rape or castor oil combined with chloride of sulphur in such a way as to completely saturate the oil. The chloride of sulphur is usually diluted with benzine. The brown or black substitutes are made by adding sulphur, *i. e.*, by the sulphuration of vegetable oil, usually oxidized oil. Adding vaseline and some mineral oil and paraffin wax before sulphurization is sometimes employed.

As before stated, corn-oil products producing rubber sponges and rubber materials of various kinds the writer has seen on exhibit. For exhibit, I present herewith a sample of rubber substitute made of corn oil, which has been vulcanized.

UNIVERSITY OF KANSAS, LAWRENCE.

CORN OIL AND A NEW POINT OF VIEW IN FOOD VALUES.

L. E. SAYRE.

AT a former meeting of the Academy (1915) the writer presented a paper on corn oil, in which he endeavored to show the value of this product in making of medicinal preparations, and intimated that its use could be extended in various directions, not least among which was in the form of a dietetic as a salad oil and in salad-oil dressings. Since that time a very large number of experiments have been performed and further study of the subject of corn oil has been made.

Ever since corn has been used in large quantities for the purpose of the manufacture of starch there has existed a desire to recover the oil from the kernel, which would otherwise be wasted; and as the average Indian corn contains from 4 to 5 percent of oil, the importance was realized by the manufacturers of starch, as some of these used as much as from 20 to 40,000 bushels of corn per day. It is needless to say that the kernel or germ of the corn contains the oil, as has been before stated, to the amount of about 4 or 5 percent. In order to recover this the kernel must be separated, and then a process of hydraulic pressure is used. After the crude oil is recovered the process of refinement follows. This latter process has become very much improved, until to-day we have a product which from the pure-food point of view is a remarkably fine article.

From one of the manufacturing houses I have obtained the following figures as to the output of corn oil last year: "Roughly speaking," the communication states, "last year 82,000,000 pounds of crude corn oil were produced in the United States, at least one-half of which was refined."

Becoming interested in this product, we have obtained large quantities of it for the purpose of distribution in order to ascertain whether the product was edible, and it is gratifying to state that in every case the report has been favorable as an oil suitable for salad dressing. A small amount is now used by some for making the camphorated oil, which is a solution of camphor in a fixed oil. It is also used in some of the leading biscuit and cracker plants in the United States and also by bread bakers throughout the country. Corn oil is also used in the manufacture of artificial rubber, attention to which will be called in another paper. The advantage to the cracker bakers in using the oil is evidenced by the constant changing of the large consumers from cottonseed oil to corn oil, which is due to its better keeping qualities and on account of its being more economical. The contention is made by the manufacturers that the corn oil is much cheaper to handle; being liquid, it can be pumped from one department to another or handled by gravity from overhead tanks, and makes an ideal shortening from a physical working standpoint.

The crude oil is largely used by soap makers, and sometimes by confectioners in oiling their slabs. The smoking point of the oil is very high, namely, 650° F., and lard 350° F., while refined cottonseed oil smokes at 500° F. When goods are cooked in or with fats having higher melting point a coating of fat is often formed over the other constituents, and the digestion of the proteins and carbohydrates is retarded, since the materials which are coated with a layer of fat will not be permeated readily by the saliva or the gastric juices. This is not the case when corn oil is used, due to its low melting point. Refined corn oil is stated to have the energy value of about 4,000 calories per pound, while butter, containing a considerable percentage of water and salt, shows usually only 83 to 85 percent of fat, with about 3,400 calories per pound.

It is worthy of note that the United States Department of Agriculture, in its Food Inspection Decision No. 169, issued

January 17, 1917, recognizes corn oil as edible, using the following phraseology: "Corn oil, maize oil, is the edible oil obtained from the germ of Indian corn, maize (*Zea mays* L.)."

In close connection with this subject the author will present another paper on corn-starch flour, which is mentioned here merely because this product, in connection with the oil, has grown to be of considerable importance from the standpoint of food economy. If corn flour can be used with a high-protein flour in bread making, it is safe to say that this fact will have a decidedly valuable commercial bearing, reducing the cost of bread and at the same time increasing the value of the corn products; but this whole question must be studied from the point of view of nutritive values, and inasmuch as bread, as well as corn oil, is dependent upon peculiar elements of nutrition, it may be not out of place to state the new point of view in regard to food values. A few salient and outstanding facts only can be referred to in this paper. Suffice to say that in discussing foods we think of them, first of all, in terms of their value in maintaining body weight, of maintaining body heat, and of their power to promote normal body growth. Foodstuffs, we say, contain five essential constituents—proteins, fats, carbohydrates, salts and water. The former of these constituents we associate with the reconstruction of depleted and broken-down cellular protoplasm. Carbohydrates and fats we think of primarily as energy producers, intimately concerned with heat production. Salts maintain osmotic and acid and base-equilibrium, and also enter into the structure of the complex cell molecule. Water is the all-important "disperse medium" for the complex colloid which we to-day know the cell to be.

But when we have finished analyzing the composition of foods for man and animals on this basis we have only come to the beginning of the knowledge developed during the last few years. The splendid work of Osborne and Mendel at the Connecticut Experiment Station and Yale University has brought out very clearly that so far as the protein constituents of foods are concerned, the amino acid and not the individual proteins are of first importance. It matters far more which of the amino acids are present than how much of them a food may contain. Of the twenty-odd amino acids found in various food proteins, two of them, lysine and tryptophane, have been shown to be indispensable in maintaining body weight and producing normal body growth. This fact alone must profoundly modify our ideas on the nutritive values of food stuffs. Practically the beginnings are now being made and we may well look to the immediate future for a much larger application of this knowledge.

Side by side with our advances on the amino acid contents of foods has come the realization that certain other constituents of foodstuffs are intimately concerned with their nutritional value. The work of McCollum and his coworkers at Wisconsin has shed much light on this phase of nutritional investigation. They have succeeded in isolating two substances, one water soluble, the other alcohol soluble, which play important and indeed essential roles in maintaining normal growth and development in animals. Nothing as to the composition of these two substances is known, and they have been labeled for the present as water-soluble A, and alcohol-soluble B. This work constitutes a second link in our understanding of the chain of nutritional metabolism. It may safely be said that the future has many surprises in store for us along these lines. If there is one thing we may profit by as a result of the late investigations mentioned it is the fact that the little heretofore considered unimportant constituents may play a role quite as profound as do the more obvious and abundant ones.

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